REMARKS

Applicant submits that this Amendment After Final Rejection places this application in condition for allowance by amending claims in manners that are believed to render all pending claims allowable over the cited art and/or at least place this application in better form for appeal. This Amendment is necessary to clarify certain claim limitations and was not earlier presented because Applicant believed that the prior response(s) placed this application in condition for allowance, for at least the reasons discussed in those responses. Accordingly, entry of the present Amendment, as an earnest attempt to advance prosecution and/or to reduce the number of issues, is requested under 37 C.F.R. §1.116.

In the event that the Office declines to enter the present Amendment, and (i) any portion of the present Amendment would place some of the claims in better form for appeal if a separate paper were filed containing only such amendments or (ii) any proposed amendment to any claim would render that claim allowable, Applicant respectfully requests that the Office inform Applicant of the same pursuant to MPEP §714.13.

By this amendment, the specification has been amended to correct a minor typographical error. Claims 1 and 15-17 have been amended. Claims 1-2, 4-5 and 7-17 remain in this application. This application has been carefully considered in connection with the Examiner's Action. Reconsideration, withdrawal of the final action, and allowance of the application is requested.

Amendments to the Specification

A minor typographical error was noted in the specification and corrected as indicated above. In the paragraph on page 7, lines 4-9, a discussion of FIG. 1 is provided. With reference to FIG. 1, please note that two pairs of pixels indicated with respective reference numbers 114, 116 and 118, 120 are depicted. The *first pair* of pixels 114, 116 is disposed *on the path* 112 on a *location corresponding to* the *transition*

between the *first object* 106 to the *second object* 104. The *second pair* of pixels 118, 120 is disposed *on the* path 112 on *another location corresponding to* the *transition* between the second object 104 and the *third* object 102. As supported by the cited text and as shown in FIG. 1, each pair of pixels (114,116) and (118,120) is distinct and located at separate transitions disposed on the path 12.

Rejection under 35 U.S.C. §103

Claim 1:

Claim 1 now more clearly recites a method of generating, from a single view input image, a depth map comprising depth values representing distances to a viewer, for respective pixels of the image, the method comprising:

computing cost values, wherein the cost values comprise respective measures of ***(i)*** a number of and ***(ii)*** extent of *transitions* in luminance and/or color and/or color components for pixels of the image on a path related to a spatial disposition of objects in the image, wherein said computing cost values includes computing a cost value for a first one of the pixels of the image by ***(a)*** accumulating differences between luminance and/or color and/or color component values of ***(b)*** pairs of neighboring connected pixels, wherein *each pair* of neighboring connected pixels is distinct and located at separate transitions, wherein ***(c)*** the separate transitions are disposed on ***(d)*** the path, wherein the path comprises a group of connected pixels that *extends from* ***(e)*** the first one of the pixels *to* ***(f)*** a second one of the pixels, wherein the second one of the pixels belongs to ***(g)*** a predetermined subset of the pixels of the image; and

assigning a depth value corresponding to the first one of the pixels on basis of the computed cost value.

Support for the amendments to claims 1 and 15-17 can be found in the specification at least on page 2, lines 21-25; page 6, lines 31-32; page 7, lines 4-9, 20-23 and 31-32; and in FIGs. 1 and 2 ((114,116), (118,120) of path 112) of FIG. 1; ((210,212), (206,208) of path 202 and (222,224), (218,220) of path 216).

Claims 1-4 and 6-13 and 15-17 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Wilinski et al. (WIPO Publication No. 02/095680; hereinafter "**Wilinski**") in view of Zheng et al. (0. Zheng, R. Chellappa; Estimation of Illuminant Direction, Albedo, and Shape from Shading; IEEE Transactions of Pattern Analysis and Machine Intelligence, Vol. 13, July 1991; hereinafter "**Zheng**"), Redert et al. (WIPO Publication No. 2004/066212; hereafter "**AAPA**") and Wu et al. (Z. Wu, L.Li; A Line-Integration Based Method for Depth Recovery from Surface Normals; IEEE, November 1988; hereinafter "**Wu**"). With respect to claim 1, Applicant respectfully traverses this rejection on the grounds that these references are defective in establishing a prima facie case of obviousness.

Independent claim 1 has been amended to more clearly define that which applicant regards as the invention. In particular, claim 1 as now presented recites, inter alia, the specific feature limitation of "computing cost values … [that] comprise respective measures of ***(i)*** a number of and ***(ii)*** extent of *transitions* in luminance and/or color and/or color components for pixels of the image on a path related to a spatial disposition of objects in the image, wherein … computing … includes computing a *cost value* for a *first one* of the pixels of the image by ***(a)*** *accumulating differences* between luminance and/or color and/or color component *values* of ***(b)*** *pairs* of neighboring connected *pixels*, wherein *each pair* … is *distinct* and *located* at *separate transitions*, wherein ***(c)*** the *separate transitions* are *disposed* on ***(d)*** the *path*, … the *path* comprises a group of *connected pixels* that extends *from* ***(e)*** the *first one* of the pixels *to* ***(f)*** a *second one* of the pixels … [that] belongs to ***(g)*** a predetermined subset of the pixels of the image; and *assigning* a *depth value* corresponding to the *first one* of the pixels *on*

basis of the *computed cost value*" (emphasis added). Support for claim 1 (as well as claims 15-17) can be found in the specification at least on page 2, lines 21-25; page 6, lines 31-32; page 7, lines 4-9, 20-23 and 31-32; and in FIGs. 1 and 2 ((114,116), (118,120) of path 112) of FIG. 1; ((210,212), (206,208) of path 202 and (222,224), (218,220) of path 216).

Applicant submits that neither **Wilinski**, **Zheng**, **AAPA** nor **Wu** discloses, nor suggests, either alone or in combination, at least the aforementioned specific feature limitation of independent claim 1, for one or more of the following reasons.

The **Wilinski**, **Zheng**, **AAPA** and **Wu** patents cannot be applied to reject claim 1 under 35 U.S.C. § 103 which provides that:

> *A patent may not be obtained ... if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains ...* (Emphasis added)

When evaluating a claim for determining obviousness, all limitations of the claim must be evaluated. However, since neither **Wilinski**, **Zheng**, **AAPA** nor **Wu** teaches or suggests the aforementioned specific feature limitation as recited in claim 1, it is impossible to render the subject matter of claim 1 as a whole obvious, and the explicit terms of the statute cannot be met.

The Office Action alleges that "**Wilinski** teaches a method for generating from a single view input image, a depth map comprising depth values representing distances to a viewer, for respective pixels of the image ... and *assigning* a *depth value* in a *first group* of depth values corresponding to the pixel (so that pixels belonging to the same image segment are assigned the same group of pixel values ... ; see p. 10, lines 26-28 for *assigning* to a pixel the *depth value* of the *segment it belongs to*)" (emphasis added,

see Office Action, page 5, lines 11-16). Applicant respectfully disagrees. With respect to "depth values", **Wilinski** discloses that "[d]etermination of depth values per se is known from the art" (see Wilinski, page 8, lines 2-4). With respect to extracting depth information from images, **Wilinski** discloses that "[d]epth information can be extracted out of the subsequent images forming video material in real time in the 3D TV or in a set-top box. This approach *has the disadvantage* that it is rather *costly* because of the *considerable calculation resources* that are required." (emphasis added, see Wilinski, page 1, lines 7-9). It appears that **Wilinski** suggests against extracting depth information in view of considerable calculation resources required. Accordingly, with regards to depth values, the disclosure in **Wilinski** amounts to no more than a general statement (or statements) regarding determination of depth values. However, Claim 1 explicitly requires "*assigning* a *depth value* corresponding to the first *one* of the pixels *on basis of* the *computed cost value*." Since **Wilinski** computes no cost value, **Wilinski** cannot reasonably be interpreted to teach or suggest "*assigning* a *depth value* corresponding to the first *one* of the pixels *on basis of* the *computed cost value*" as is recited in Claim 1.

In addition, the Office Action *concedes* that "Wilinski *does not explicitly teach* computing cost values that comprise respective measures of a number of and extent of transitions in luminance and/or color components for pixels of the image on a path related to a spatial disposition of objects in the image, wherein said computing includes computing a cost value for a first one of the pixels of the image by accumulating differences between luminance and/or color values of pairs of neighboring connected pixels at transitions which are disposed on a path from the first one of the pixels to a second one of the pixels wherein the second one of the pixels belongs to a predetermined subset of the pixels of the image." (emphasis added, see Office Action, page 6, lines 1-8).

The Office Action however alleges that "Wilinski *does teach* detecting transitions between objects in the image by contours (see p. 7, lines 29 and 30 for segmentation based on luminosity; see p. 5, lines 12-18 for using a method for detecting edges by intensity changes); and as mentioned before assigning depth to pixels in those edges, and through them to pixels in their segment." (emphasis added, see Office Action, page 6, lines 8-12). However, Applicant respectfully disagrees with application of the teaching of **Wilinski** with respect to "assigning" as it is specifically relates to the limitation recited in claim 1 regarding "*assigning* a *depth value* corresponding to the first *one* of the pixels *on basis of* the *computed cost value*", further for at least the reasons stated herein above.

The Office Action further alleges that **Zheng** remedies the conceded deficiency in **Wilinski** in that "Zheng however teaches a method to obtain shape from shading using contours (see abstract; see p. 684, 1st col., 2nd par.), where the *value* of the *intensity difference* across *an edge* is *determined* and *if* it is *above* a *threshold*, *detects* a *relative depth variation* between the *segments* (see p. 684, 2nd col., 3rd and 4th pars.)." (emphasis added, see Office Action, page 6, lines 12-16). However, claim 1 specifically requires that "the cost values comprise respective measures of ***(i)*** a number of and ***(ii)*** extent of *transitions* … for pixels of the image *on a path* related to a *spatial disposition* of *objects* in the image" (emphasis added). Thus, **Zheng** does not add anything which would remedy the deficiency of **Wilinski** with respect to the "computed cost values" as recited in claim 1. In particular, **Zheng** discloses a "Contour-Based Method" which comprises an estimation method based on shading analysis around object boundaries (see Zheng, page 684, 1st col. lines 5-9). In addition, **Zheng** discloses "[i]n our algorithm, we just *detect zero-crossings* as boundaries, *estimate* the *tangent* of the *curve* by smoothing the zero-crossing edge, *and compute* the *intensity variances* on both sides of the *edge along* directions *perpendicular* to the *tangent* of the *curve*. If the difference between these two variances is above a threshold, the side with smaller

variance is chosen as the background." (see Zheng, page 684, 2nd col., lines 21-27). However, Applicant respectfully disagrees with application of the teaching of **Zheng** in which "determining the depth of edges in the image by examining intensity differences across edges" and "the side with smaller variance is chosen as the background" as it specifically relates to the limitation recited in claim 1 regarding "cost values" and "*assigning* a *depth value.*" The "[c]hoosing a side with smaller variance as the background" of **Zheng** does not teach or suggest "*assigning* a *depth value* corresponding to the first *one* of the pixels *on basis of* the *computed cost value*" nor "the cost values comprise respective measures of ***(i)*** a number of and ***(ii)*** extent of *transitions* ... for pixels of the image *on a path* related to a *spatial disposition* of *objects* in the image" (emphasis added) as now recited in claim 1. By contrast, **Zheng**, as noted herein above, discloses computing "the *intensity variances* on both sides of the *edge along* directions *perpendicular* to the *tangent* of the *curve*." In view of the above, **Zheng** does not provide a teaching which renders obvious or remedies the aforementioned, conceded deficiency in the citation to **Wilinski** of the second immediately previous paragraph.

Still further, the Office Action alleges "[b]ecause Wilinski teaches performing segmentation of an image and depth determination of the pixels at the contours generated, and Zheng teaches determining the depth of edges in the image by examining intensity differences across edges, it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the image segmentation and depth determination taught in Wilinski with the depth determination across edges taught by Zheng. This combination is *implicitly* suggested by Wilinski, which discloses *segmentation and depth determination of edge pixels* by known methods, and *expressly* by Zheng, which discloses that *the method can be improved by performing segmentation first*; see the last three lines of page, 684, 2nd col., 3rd par." (see Office Action, page 6, line 16 to page 7, line 3). While there may be reason to combine

Wilinski and **Zheng** as between the references themselves, as per the Office Action; however, the references are deficient as discussed herein above. Applicant respectfully submits that the alleged combination fails to teach or suggest aforementioned specific feature limitation recited in claim 1, as now presented. That is, claim 1 requires "computing cost values … [that] comprise respective measures of ***(i)*** a number of and ***(ii)*** extent of *transitions* in luminance and/or color and/or color components for pixels of the image on a path related to a spatial disposition of objects in the image, wherein … computing … includes computing a *cost value* for a *first one* of the pixels of the image by ***(a)*** *accumulating differences* between luminance and/or color and/or color component *values* of ***(b)*** *pairs* of neighboring connected *pixels*, wherein *each pair* … is *distinct* and *located* at *separate transitions*, wherein ***(c)*** the *separate transitions* are *disposed* on ***(d)*** the *path*, … the *path* comprises a group of *connected pixels* that extends *from* ***(e)*** the *first one* of the pixels *to* ***(f)*** a *second one* of the pixels … [that] belongs to ***(g)*** a predetermined subset of the pixels of the image; and *assigning* a *depth value* corresponding to the *first one* of the pixels *on basis of* the *computed cost value*" (emphasis added).

In addition to the above, it is submitted that the citation to **Wu** and **AAPA** does not remedy the conceded deficiency in the citation to both **Wilinski** and **Zheng**. Accordingly, without conceding the propriety of the asserted combination, the asserted combination of **Wilinski**, **Zheng**, the combination of **AAPA** and **Wu** is likewise deficient, even in view of the knowledge of one of ordinary skill in the art.

The Office Action *explicitly concedes* that, with respect to the citation of **Wilinski** and **Zheng**, "[n]either **Wilinski** nor **Zheng** teach that the measurements for depth are taken along a path which results in a cost function for each pixel which is being examined for depth, where the cost value comprises respective measures of a number and extent of transitions in luminance and/or color and/or color components for pixels of

the image on a path related to the spatial disposition of objects of the image, wherein said computing includes computing a cost value for a first one of the pixels of the image by accumulating differences between luminance and/or color and/or color component values of pairs of neighboring connected pixels at transitions which are disposed on a path from the first one of the pixels to a second one of the pixels, wherein the second one of the pixels belongs to a predetermined subset of the pixels of the image; and assigning a depth value corresponding to the first one of the pixels on basis of the calculated cost value" (See Office Action, page 7, line 4-15). As now presented, it is further respectfully submitted, as noted above, that neither **Wilinski** nor **Zheng** teach "computing cost values … [that] comprise respective measures of ***(i)*** a number of and ***(ii)*** extent of *transitions* in luminance and/or color and/or color components for pixels of the image on a path related to a spatial disposition of objects in the image, wherein … computing … includes computing a *cost value* for a *first one* of the pixels of the image by ***(a)*** *accumulating differences* between luminance and/or color and/or color component *values* of ***(b)*** *pairs* of neighboring connected *pixels*, wherein *each pair* … is *distinct* and *located* at *separate transitions*, wherein ***(c)*** the *separate transitions* are *disposed* on ***(d)*** the *path*, … the *path* comprises a group of *connected pixels* that extends *from* ***(e)*** the *first one* of the pixels *to* ***(f)*** a *second one* of the pixels … [that] belongs to ***(g)*** a predetermined subset of the pixels of the image; and *assigning* a *depth value* corresponding to the *first one* of the pixels *on basis of* the *computed cost value*" (emphasis added) as recited in claim 1.

Nonetheless, the Office Action rejects independent claim 1, contending that **AAPA** and **Wu** provides teaching which renders this necessary disclosure obvious (See Office Action, page 7, line 15 – page 9, line 7). The Office Action contends that: "AAPA however teaches that it is known in the art to provide algorithms that result in relative depth orderings, and further, to supply depth values as a first derivative of the depth value. The examiner, therefore, considers obvious that, since the depth determination

disclosed in Zheng is a relative depth between the two segments delimitated by the contour, that is, the change in depth across two segments, one of ordinary skill in the art would have understood that Zheng provides a qualitative depth value that comprises the first order derivative of the depth as taught by AAPA. One of ordinary skill in the art at the time of the invention would therefore find it obvious to obtain global depth information for the pixels in the image provided with segment and relative depth information as taught by Wilinski and Zheng through the integration of the first order derivative of depth provided. In order to do this, the Examiner considers that it would have been obvious to one of ordinary skill in the art at the time of the invention to examine the different transitions along a path from the pixel to one of the edges of the image and to sum these differences which translate in depth differences as taught by Zheng." (see Office Action on page 7, line 15 – page 8, line 7). This contention is respectfully traversed. Applicant respectfully submits that the alleged combination fails to teach or suggest aforementioned specific feature limitation recited in claim 1, as now presented. Both **Wilinski** and **Zheng** are deficient as discussed herein above. Furthermore, the **AAPA** fails to disclose that which is missing from **Wilinski** and **Zheng**. Claim 1 specifically requires "computing a *cost value* for a *first one* of the pixels of the image by ***(a)*** *accumulating differences* between luminance and/or color and/or color component *values* of ***(b)*** *pairs* of neighboring connected *pixels*, wherein *each pair* … is *distinct* and *located* at *separate transitions*, wherein ***(c)*** the *separate transitions* are *disposed* on ***(d)*** the *path*, … the *path* comprises a group of *connected pixels* that extends *from* ***(e)*** the *first one* of the pixels *to* ***(f)*** a *second one* of the pixels … [that] belongs to ***(g)*** a predetermined subset of the pixels of the image."

The Office Action further alleges that: "[r]econstructing shape information from shading through the use of paths is well known in the art, as shown, for example in Wu (see abstract). … The Examiner also further notes that the change in depth between pixels along the path is obtained independently from the method disclosed in Wu, by a

shape from shading algorithm, see section III., first par., and further, that the change in depth over space disclosed in Wu, since depth is obtained from shape from shading indeed constitutes a change in luminance over space, as taught by Zheng. See also, p. 3, lines 10-16 in the Applicant's specification for the equivalence of accumulation and integration. Using a line integral such as that taught by Wu would have been obvious to one of ordinary skill in the art in view of Zheng, Wilinski and AAPA, as it is well-known in the art, the integral is the reverse of the derivative, and therefore, the line integral across boundaries that provide a slope of depth naturally provides the total depth difference between the beginning of the line and the end, again as is well-known in the art." (see Office Action on page 8, line 7 – page 9, line 7). This contention is respectfully traversed. Applicant respectfully submits that the alleged combination fails to teach or suggest aforementioned specific feature limitation recited in claim 1, as now presented. The combination of **Wilinski**, **Zheng** and **AAPA** is deficient as discussed herein above. In addition, while **Wu** discloses a line-integration based method for depth recovery from *surface normals*, **Wu** fails to disclose that which is missing from **Wilinski**, **Zheng** and **AAPA**. In particular, **Wu** fails to disclose "computing a *cost value* for a *first one* of the pixels of the image by ***(a)*** *accumulating differences* between luminance and/or color and/or color component *values* of ***(b)*** *pairs* of neighboring connected *pixels*, wherein *each pair* … is *distinct* and *located* at *separate transitions*, wherein ***(c)*** the *separate transitions* are *disposed* on ***(d)*** the *path*, … the *path* comprises a group of *connected pixels* that extends *from* ***(e)*** the *first one* of the pixels *to* ***(f)*** a *second one* of the pixels … [that] belongs to ***(g)*** a predetermined subset of the pixels of the image" as specifically required by claim 1.

Thus, a *prima facie* case of obviousness has clearly not been met, and the rejection under 35 U.S.C. §103 should be withdrawn.

Accordingly, claim 1 is allowable and an early formal notice thereof is requested. Claims 2, 4 and 7-13 depend from and further limit independent claim 1 and therefore are allowable as well. The 35 U.S.C. §103(a) rejection thereof has now been overcome.

Withdrawal of the rejection is respectfully requested.

Claims 15, 16 and 17 contain limitations similar to those of claim 1. Accordingly, for similar reasons as stated with respect to overcoming the rejection of claim 1, claims 15, 16 and 17 are believed allowable and an early formal notice thereof is requested. The 35 U.S.C. § 103(a) rejection thereof has now been overcome. Withdrawal of the rejection is respectfully requested.

Claim 5 stands rejected under 35 U.S.C. §103(a) as being unpatentable over **Wilinski** in view of **Zheng**, **AAPA** and **Wu** as applied to claim 1 above, and further in view of Cahill et al. (U.S. Patent Publication No. 2004/0062439, hereinafter "**Cahill**"). Applicant respectfully traverses this rejection for at least the following reason. Claim 5 depends from and further limits allowable independent claim 1 and therefore is allowable as well. The 35 U.S.C. §103(a) rejection thereof has now been overcome. Withdrawal of the rejection is requested.

Claim 14 stands rejected under 35 U.S.C. §103(a) as being unpatentable over **Wilinski** in view of **Zheng**, **AAPA** and **Wu** as applied to claim 12 above, and further in view of Nakatsuna et al. (U .S. Patent Publication No. 2002/0154116; hereinafter "**Nakatsuna**"). Applicant respectfully traverses this rejection for at least the following reason. Claim 14 depends from and further limits dependent claim 12, which is dependent from allowable independent claim 1 and therefore is allowable as well. The 35 U.S.C. §103(a) rejection thereof has now been overcome. Withdrawal of the rejection is requested.

Conclusion

Except as indicated herein, the claims were not amended in order to address issues of patentability and Applicants respectfully reserve all rights they may have under the Doctrine of Equivalents. Applicants furthermore reserve their right to reintroduce subject matter deleted herein at a later time during the prosecution of this application or a continuation application. In addition, the Office Action contains various statements characterizing the claims, the specification, and the prior art. Regardless of whether such statements are addressed by Applicant, Applicant refuses to subscribe to any of these statements, unless expressly indicated by Applicant.

The matters identified in the Office Action of October 26, 2010 are now believed resolved. Accordingly, the application is believed to be in proper condition for allowance. Withdrawal of the final action and issuance of an early formal notice of allowance of claims 1-2, 4-5 and 7-17 is requested.

Respectfully submitted,

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